4.6: Applying Exponent Properties

Exponent Rules

① Multiplication rule

$$x^3 \cdot x^4 = x^7$$

When you multiply like bases, you add the exponents.

② Division Rule

$$x^8 \div x^5 \quad \text{or} \quad \frac{x^8}{x^5} = x^3$$

When you divide like bases, you subtract the exponents

③ Power Rule

$$(x^3)^2 = x^6$$

When you have an exponent to another power, you multiply

④ Zero Property

Any term to the power of zero is 1.

$5^0 = 1$ $\quad -3m^0 = -3$

$(-3m)^0 = 1$

⑤ Negative Exponent

A negative exponent means reciprocal of the base

$$\left(\frac{2}{3}\right)^{-1} \Rightarrow \frac{3}{2}$$

⑥ Fraction Exponents

The denominator of the fraction exponent is the index of the radical.

$$27^{1/3} \Rightarrow \sqrt[3]{27}$$

Practice Examples

1. $x^{-9} \cdot x^{6} = x^{-3} = \left(\frac{1}{x}\right)^{3} = \frac{1}{x^{3}}$

2. $\frac{x^{9}}{x^{-3}} \Rightarrow x^{9-(-3)} = x^{12}$

3. $\frac{x^{5} \cdot x^{-2}}{x^{3}} = \frac{x^{3}}{x^{3}} = x^{3-3} = x^{0} = 1$

4. $\left(2^{1}x^{-1}\right)^{3} = 2^{3}x^{-3} = 8\left(\frac{1}{x^{3}}\right) = \frac{8}{x^{3}}$

Don't forget the 2!

5. $\frac{m^{4}\,n^{-2}\,p^{1}}{m^{-2}\,n^{1}\,p^{-4}} = m^{6}n^{-3}p^{5} = \frac{m^{6}p^{5}}{n^{3}}$

6. $\frac{\left(3^{1}a^{1}\right)^{2}}{\left(2ab\right)^{3}} = \frac{3^{2}a^{2}}{2^{3}a^{3}b^{3}} = \frac{9a^{2}}{8a^{3}b^{3}} = \frac{9a^{-1}}{8b^{3}}$

$= \frac{9}{8ab^{3}}$